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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/988,246	12/01/1997	SEBASTIEN RAOUX	AM1771-4-T19	7250

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EXAMINER	
ZERVIGON, RUDY	
ART UNIT	PAPER NUMBER
1763	26

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Please find below and/or attached an Office communication concerning this application or proceeding.

T-D-26

Office Action Summary

Application No.	Applicant(s)
08/988,246	Sebastien et al
Examiner	**Art Unit**
Rudy Zervigon	1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Oct 15, 2001*

2a) ☒ This action is **FINAL.** 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *3-14, 16, 19-24, and 26-30* is/are pending in the applica

4a) Of the above, claim(s) *7-10* is/are withdrawn from considera

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *3-6, 11-14, 16, 19-24, and 26-30* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirem

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☐ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 16 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 16 requires "a matching network coupled to a high frequency RF generator and said gas manifold" as required by claim 16 and supported on page 9, lines 1-9 of the specification. However, applicant should amend "coupled" to the more accurate "electrically coupled" for consistency with the specification and removal of ambiguity.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 3, 4, 6, 11-14, 16, 19-21, 23, 24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadahiro Ohmi (U.S.Pat. 5,272,417) in view of Patrick et al (U.S.Pat. 5,474,648). Tadahiro Ohmi teaches:

i. A substrate processing system (Figure 1a) using a deposition chamber (item 105, Figure 1a; column 6, lines 25-38) encasing a reaction zone

ii. A substrate processing system using a substrate holder as a low frequency (LF) electrode (item 104, Figure 1a; column 6, lines 26-27)

iii. A gas introduction system including a gas inlet (item 107, Figure 1; col.17,lines 60-65) for supplying one or more process gas(es) to the reaction zone as discussed by Tadahiro Ohmi according to "raw material gases are discharged by high frequency power source f1 and turned to plasma." (Col.17, lines 62-63)

iv. A high frequency (HF) electrode (item 107, Figure 1a; column 6, lines 25-27)

v. A plasma power source (items 111, 110, Figure 1a; column 6, lines 63-69) for forming plasma within the reaction zone of the additive or subtractive reaction zone (column 1, lines 5-17)

Roger Patrick et al (U.S.Pat.5,474,648) details a dynamic control and delivery of radio frequency power in plasma process systems. **The processing is utilized to enhance the repeatability and**

uniformity of the process plasma. Power, voltage, current, phase, *impedance*, harmonic content and direct current bias of the radio frequency energy being delivered to the plasma chamber may be monitored at the plasma chamber and used to control or characterize the plasma load. Dynamic pro-active control of the characteristics of the radio frequency power to the plasma chamber electrode during the formation of the plasma enhances the uniformity of the plasma (ABSTRACT).

In addition the Patrick et al sensor (202; column 7, lines 14-20) may also measure the voltage, current and phase angle at the chamber electrode (items 112 and 114; column 6, line 64), ***and measure the chamber impedance (column 4, lines 37-40)***. Patrick et al additionally teach variable capacitors (items 106 and 108; Figure 2A) of a matching network (120, Fig.2A) suitable for use in the matching circuit of Tadahiro Ohmi.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the Patrick impedance monitor electrically as coupled to each of the low and high frequency electrodes of Tadahiro Ohmi.

Motivation for implementing the Tadahiro Ohmi impedance monitor electrically coupled to each of the low and high frequency electrodes is directed to providing a chamber impedance measurement and control for uniform processing. C≤l57-C6l32

5. Claims 5 and 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tadahiro Ohmi (U.S.Pat. 5,272,417) in view of Patrick as applied to claims 3, 4, 6, 11-14, 16, 19-21, 23, 24, and 26 above, and further in view of Boys et al (U.S.Pat.4,500,408). Tadahiro Ohmi (U.S.Pat. 5,272,417) does not teach a pressure control system based on measured plasma attributes such as impedance. Boys et al describe a magnetron sputter coating apparatus controlled in response to measurements of plasma parameters to control deposition parameters (abstract). Specifically, Boys et al describe:

vi. a pressure control system (column 12, lines 51-53) configured to control a pressure level within the chamber and controllably coupled to the processor wherein the processor controls the pressure control system to vary the pressure within the chamber in response to the measured impedance level of the plasma (column 22, lines 61-66)

Boys et al additionally teach a plurality of impedance measuring devices as manifested by plasma voltage and plasma current measurements (items 45, 46; Fig.1; column 11, lines 43-45).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the pressure control system as described by Boys et al to be an obvious extension to the Patrick et al impedance data collection and control system.

Motivation for implementing the pressure control of Boys et al based on measuring the plasma impedance as part of the Patrick et al impedance data collection and control system is directed "To control deposition rate and coating distribution accurately over a period of time, it is necessary to control both plasma voltage and plasma current for a specific plasma power. Plasma voltage and plasma current are a function of plasma impedance.....Thus the two variables that can be varied to control plasma impedance are the pressure of the working gas in volume 13 and the magnetic field applied by cathode assembly 17 to target 15 and volume 13." (Column 11, lines 40-45; lines 56-59).

Response to Arguments

6. Applicant's repeated arguments filed October 15, 2001 have been fully considered but they are again not persuasive.

7. With respect to Patrick et al not teaching "the use of both HF and LF RF" is again not accurate per Patrick et al's discussion as quoted by Chun-Pok Leung - "This RF energy may be low frequencies (below 550KHz), high frequencies (13.56MHz), or microwaves (2.45GHz).". And further along in column 1 of Patrick et al:

"The process vessel is used to maintain the low pressures required for the plasma and to serve as a structure for attachment of one or more radio frequency sources." (Lines 39-43) - This translates into:

At least two power "sources" (plural) supporting plasma conditions across two electrodes (112 & 114, Fig.1). Where each of these two electrodes operating in the frequency ranges between LF and HF (column 1, lines 50-51).

8. With respect to the "references" not teaching "the recited impedance monitor and processor", it is again emphasized that Patrick et al does explicitly teach a sensor (202; column 7, lines 14-20) that monitors voltage, current, chamber impedance (column 4, lines 37-40), and phase angle at the chamber electrode (items 112 and 114; column 6, line 64) as recited in prior actions on the merit. Moreover, real-time processor control of voltage, current, chamber impedance, and phase angle of power delivered to the chamber electrodes is taught by Patrick et al (column 3, lines 61-67) as was discussed in prior actions on the merit.

9. With regard to Applicant's position concerning the Ohmi reference that "The electrode (104) is a second high-frequency electrode at a frequency of 100 MHZ, **not** an LF electrode" is a recitation of how an apparatus is used. Applicant is instructed to read MPEP 2114 which teaches that apparatus claims must be structurally distinguished from the prior art.

10. It is agreed that Ohmi does not teach an impedance monitor, and for this reason Patrick et al is cited for this deficiency with proper motivation (column 5, line 57-column 6, line 32) provided by Patrick et al for implementing such a control system in the Ohmi apparatus.

11. Applicant's arguments "...the two impedance probes as recited in claim 11 are novel and produce new and unobvious results." fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

12. Applicant's contention that "Boys et al also fails to disclose or suggest the impedance monitor and processor as recited in claim 11 from which claims 5 and 27-29 depend..." is again grossly inaccurate. Specifically, Boys et al makes specific teachings of the highly important relationship between the plasma process variables of **impedance**, chamber geometry, **gas pressure**, and the magnitude and geometry of the magnetic field (column 1, lines 45-60). Additionally, Boys et al specifically sites prior art deficiencies to Turner that DO NOT perform "closed loop control" of plasma impedance (column 2, lines 14-25; 44-53). And finally, PID control of plasma impedance is taught and motivated by Boys et al (column 4, lines 29-40). Furthermore, Boys et al teaches power level adjustment/control based on plasma impedance (column 11, lines 40-45) as derived from

pressure and magnetic field measurements (column 1, lines 42-55; "measured plasma pressure" - column 12, lines 51-53; "measured values of the magnetic field" - column 17, lines 38-55). It is conceded however, that Boys et al does not teach "impedance probes" as does Patrick et al as stated prior. Yet, as discussed above, Boys et al couples the measurement of the variables of chamber pressure and magnetic field as a reflection of impedance.

13. With regard to Applicant's assertions on page 8 with respect to Patrick et al, it remains the Examiner's opinion that Patrick et al's matching network (120; column 6, lines 59-67) has variable capacitors (106,108) that are electrically and controllably coupled to the processor wherein the processor (204) adjusts a capacitance level of the variable capacitor(s) to vary the impedance of the plasma in response to an output of the impedance monitor (claim 5). Moreover, as stated in prior actions, motivation for combining Ohmi and Patrick et al references is discussed by Boys et al: "To control deposition rate and coating distribution accurately over a period of time, it is necessary to control both plasma voltage and plasma current for a specific plasma power. Plasma voltage and plasma current are a function of plasma impedance.....Thus the two variables that can be varied to control plasma impedance are the pressure of the working gas in volume 13 and the magnetic field applied by cathode assembly 17 to target 15 and volume 13." (Column 11, lines 40-45; lines 56-59).

14. Applicant's position that none of the references of record supply explicit support for "a matching network coupled to a high frequency RF generator and said gas manifold" as required by claim 16 and supported on page 9, lines 1-9 of the specification. However, applicant should amend "coupled" to the more accurate "electrically coupled". See the 35 USC 112 rejection above. Specific

reference by Ohmi is made to coupling a "high frequency power source" to the raw material gases (column 17, lines 60-65).

15. With regards to a processor used to adjusting the capacitance level of the variable capacitors is provided by Patrick et al as discussed above of a matching network (120, Fig.2A) that is changed in response to sensed conditions (column 7, lines 38-44).

Conclusion

16. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before

final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

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